narrow physical law. Through careful investigation of light, the discussion illustrates the manner in which virtually all scientific knowledge develops. Under our continued scrutiny, the simple particle picture proves inadequate, and the student is led to concede that before we can proceed usefully with the study of light, we need to understand wave phenomena.

It is not a question of presenting waves as complex dynamical systems. The student observes the behavior of ropes and ripples. Studying this behavior, particularly under controlled conditions in the ripple tank, he learns to recognize a group of characteristics that constitute wave behavior. We then find these same characteristics in the behavior of light. Thus, at the end of this portion of the course, the earlier problems concerning the nature of light are resolved. At this point, as at others, we notice the new questions that inevitably arise from what we learn; what is the medium for light that acts like water for ripples? We raise such problems to show the open-ended nature of physical thought.

During this portion of the course, which occupies approximately the first half year, dynamical considerations are subordinated. At most dynamics is treated descriptively. The principal emphasis is on the kinematics of our world: where things are, how big, and how they move, not why. The second half of the course now embarks on a study of dynamics. Newton's laws connect motions with forces. Not only can they be used to predict motions when forces are known, but they can inform us about forces when motions are observed. Thus we tell the extraordinary story of the discovery of universal gravitation. We also introduce the conservation laws, and they form a substantial portion of this section of the course. We stress their wide applicability and their use in situations where detail is inaccessible, such as cosmic ray collisions and the kinetic theory of gases.

Again in this part of the course, we go over ground viewed earlier, and the student will discover that he can read new significance into familiar material. Once again he will be impressed with the cyclical nature of the study of physics and with the constant refining process to which we subject physical knowledge. In the introductory section of the whole course, and again in the kinetic theory, we deal with submicroscopic particles. We now treat electricity as one of the fundamental characteristics of these particles. Currents, moving charges and magnets are studied. Through the induction laws we arrive at the possibility of electromagnetic waves—a subject we can only sketch. The experimental facts, however, clearly tie the electric phenomena to the electromagnetic spectrum. Another great circle is closed, binding dynamics, electricity, optics, and waves in a single embracing picture.

The apparent completeness of this picture is denied by the photoelectric effect, but a more complete picture emerges before the end of the course. Through the discrete interactions of light with matter, we see photons; and through the photons and the